2010 Annual Report on Air Emissions from Facilities at Campbell Industrial Park

Prepared by:
Clean Air Branch
Hawaii State Department of Health

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Hawaii Revised Statutes §342G-44: Double-sided copying shall be standard operating practice for all state and county agencies, offices, and facilities, as available and appropriate

Errata Sheet

In Section 1, the original description of the Hawaiian Electric Company, Campbell Industrial Park facility incorrectly states the following: "Low sulfur fuel with not more than 0.5% by weight sulfur content is used to minimize SO_2 emissions from the combustion turbine generators."

The low sulfur fuel is **0.05%** by weight sulfur content.

Hawaii Revised Statutes §342G-44: Double-sided copying shall be standard operating practice for all state and county agencies, offices, and facilities, as available and appropriate

Introduction

This report has been prepared by the Clean Air Branch of the Department of Health pursuant to the requirements set forth in Hawaii Revised Statutes (HRS) §342B-18. The purpose of the report is to provide members of the communities surrounding Campbell Industrial Park and Kahe Valley with an understanding of the circumstances and activities related to ambient air quality in those areas.

HRS 342B-18 directs the Department of Health to generate an annual report to the communities using specific information provided by the major sources located in Campbell Industrial Park and Kahe Valley. The information for this report is based on the annual data collected in 2009.

For the sake of clarity, the report is divided into three sections. Section one addresses the activities of the major sources and is split into two distinct parts. The first part of section one describes each major facility, the sources of emissions, and the air pollution controls that the facility employs to minimize its air emissions. The second part, Table A, identifies the type and quantity of criteria air pollutant emitted by each major facility for the calendar year.

Section two provides the air quality monitoring data obtained from the three monitoring stations located on the outskirts of Campbell Industrial Park. The data are presented in tabular form as well as in graphs which compare the data to the federal and state ambient air quality standards. In every case, Hawaii's air quality is far better than the national, health-based standards. The graphs also help illustrate any trend over the last five years.

The final section is a report on the measurements of the criteria and non-criteria air pollutants and the expected health effects at the measured levels. The purpose of this section is to provide the reader with an understanding of the potential impacts on human health at the existing levels of air quality.

The Clean Air Branch of the Department of Health administers the statewide air pollution control program. It consists of a permitting program which regulates the facilities, an air quality and source monitoring program, and an investigatory and enforcement program.

If you have questions about this report or about air quality, please contact the Clean Air Branch at the following:

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A copy of this report can be found at the Clean Air Branch website:
http://www.hawaii.gov/health/environmental/air/cab/index.html
Click on the link, "2010 Annual Report on Campbell Industrial Park."

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SECTION 1.
Summary of Criteria Pollutants Emitted by Major Source Facilities in Campbell Industrial Park & Kahe Valley in 2009 and a Description of the Air Pollutant Controls

Criteria Pollutants Emitted by the Facilities

The criteria pollutant emissions from the major sources in Campbell Industrial Park (CIP) and Kahe Valley are listed in **Table A**. The emissions were derived using actual operating hours or fuel usage, stack test results, continuous emission monitoring data, and standard emission factors.

Descriptions of the Respective Criteria Pollutant Controls

AES Hawaii Cogeneration Plant

AES Hawaii, Inc. operates a coal-fired cogeneration plant which generates electricity for operation and sale to Hawaiian Electric Company (HECO). Coal is imported, crushed, then fed into two (2) circulating fluidized bed (CFB) boilers. Tire derived fuel (TDF), spec used oil, and spent activated carbon are used as secondary fuel. After combustion, the air emissions flow through a selective non-catalytic reduction system and baghouse before it reaches the exhaust stack. There is also a cooling tower which extracts heat from the combustion gases and emit particulates which are dissolved solids in the evaporated water.

Total suspended particulates (TSP), particulate matter which are 10 microns or smaller (PM_{10}), sulfur dioxide (SO_2), nitrogen oxides (NO_x), carbon monoxide (CO), volatile organic compounds (VOC), and lead (Pb) are the primary air pollutants being emitted from this facility. The following briefly describes the air pollution control methods being employed. Fugitive TSP emissions are contained in enclosed structures during the transportation and processing of the coal. Baghouses also collect fugitive TSP emissions during the processing stage. During the combustion stage, a baghouse is also used to collect TSP and Pb. SO_2 is controlled by the use of limestone injection into the two (2) boilers and the use of coal fuel with a maximum sulfur content of 1.5% by weight. NO_x is controlled by the use of a selective non-catalytic reduction system for the boilers. The TSP and PM_{10} emissions from the cooling tower are controlled by limiting the water flow rate and amount of total dissolved solids within the water.

Chevron Refinery

Chevron operates a petroleum refinery which produces various types of petroleum products. Petroleum is imported by ship and stored in above ground tanks prior to processing. The petroleum is processed, or refined, to produce various petroleum products. The main emission units are storage tanks, furnaces, boilers, combustion turbines, cooling tower, and flares.

TSP, PM_{10}, SO_2, NO_x, CO, and VOC are the primary air pollutants being emitted from this facility. TSP and PM_{10} are mainly controlled by a cyclone and electrostatic precipitator (ESP) for the FCC stack. The cooling tower also emits TSP and PM_{10} which are controlled by limiting the water flow rate and amount of total dissolved solids within the water. A caustic scrubber reduces SO_2 emissions during flaring events from shutdowns or upsets. NO_x is controlled by the use of low NO_x burners in the furnaces and water injection/low NOx burners in the combustion turbines. CO and VOCs are controlled by the use of steam atomizers and excess oxygen which completes the combustion process before the exhaust is emitted through the exhaust stack. VOC is also controlled by the use of a flare, a Benzene Recovery Unit, and the employment of proper leak detection and maintenance procedures. During the storage of the petroleum products, VOC is controlled with the use of various equipment for petroleum storage tanks such as gaskets, seals, and floating roofs. Since calendar year 1998, secondary seals have been installed on all applicable hydrocarbon tanks to provide additional controls for VOC.

Hawaiian Electric Company - Campbell Industrial Park

HECO operates a biodiesel fueled combustion turbine generating station in Campbell Industrial Park. The facility operates two (2) simple cycle combustion turbine generators and two (2) black start diesel engine generators. Biodiesel for the combustion turbines is imported and stored inside above ground storage tanks. The generating station is the first biodiesel fueled combustion turbine plant in Hawaii and represents a significant step toward reducing Hawaii's dependence on fossil fuels.

Primary air pollutants emitted from this facility are SO_2, TSP, PM_{10}, $PM_{2.5}$, NO_x, CO, and VOC. A water injection system is used to control NO_X from the combustion turbine generators. The system injects demineralized water into the turbine generator's combustion chamber to reduce peak flame combustion temperature. Lowering combustion temperature reduces the formation of thermal NO_X. Low sulfur fuel with not more than 0.05% by weight sulfur content is used to minimize SO_2 emissions from the combustion turbine generators. The black start diesel engine generators are fired on ultra low sulfur content fuel with maximum 0.0015% by weight sulfur content. Good combustion practices are used for the combustion turbine generators to minimize particulate, CO, and VOC emissions. Storage tanks servicing the combustion turbine generators are equipped with internal floating roofs with tank seal systems to control VOC emissions.

Hawaiian Electric Company - Kahe Valley

HECO operates Kahe Generating Station in Kahe Valley. Fuel oil is imported, then stored in above ground storage tanks at the facility. From the storage tanks, the fuel oil is fed to the six (6) boilers and two (2) black start diesel engine generators for combustion.

TSP, PM_{10}, SO_2, NO_x, CO, and VOC are the primary air pollutants. TSP and PM_{10} are mainly controlled by the consumption of fuel oil with a low ash content. Periodic soot removal of the exhaust stacks also help control TSP and PM_{10} emissions to minimize short-term concentrations. SO_2 is controlled by the combustion of low sulfur fuel oil (< 0.5% sulfur by weight). Thermal NO_x is reduced by lowering the initial combustion temperature of the boiler units. The combustion temperature is lowered by the use of low NO_x burners, flue gas recirculation, tangential firing, and low excess oxygen. CO and VOCs are controlled by the use of steam atomizers and excess oxygen which completes the combustion process before the exhaust is emitted through the exhaust stack.

Honolulu Resource Recovery Venture (aka HPOWER)

Honolulu Resource Recovery Venture operates a municipal waste disposal facility and generates electricity for its operation and sale to HECO. The company and facility are commonly referred to as "HPOWER" for Honolulu Program of Waste Energy Recovery. The municipal waste is received, sorted, chopped, then fed into two (2) 854 ton per day refuse derived fuel (RDF) municipal waste combustors (MWCs). Another 900 ton per day mass-burn MWC with associated air pollution controls and a steam turbine are being constructed at the facility to increase plant capacity. For each RDF combustor, exhaust emissions flow through a spray dryer absorber and baghouse before reaching the exhaust stack. The resultant ash is collected in hoppers and disposed of into the landfill. There is also a cooling tower which extracts heat from the combustion gases and emits particulates which are dissolved solids in the evaporated water.

TSP, PM_{10}, $PM_{2.5}$, SO_2, NO_x, and CO and acid gases are the primary air pollutants being emitted from the RDF combustors at this facility. The following briefly describes the air pollution control methods being employed. Fugitive particulate emissions are controlled by using enclosed trucks, paved areas, and enclosed structures during the transportation and processing of the municipal solid waste. Baghouses also collect particulate emissions generated within the waste processing building. TSP, PM_{10}, $PM_{2.5}$ and MWC metals (cadmium, lead, and mercury) from the combustion stage and Spray Dryer Absorber (SDA) are abated by baghouses which are replacing electrostatic precipitotors (ESPs). Emissions of SO_2, sulfuric acid, hydrogen chloride, and hydrogen fluoride are reduced by the use of the SDA. The SO_2 precipitates and acid salts form with injection of a lime slurry inside the SDA. A portion of the dry powder drops to the bottom of the SDA scrubber vessel. Flue gases containing the remaining powder with acid gas salts and particulates generated from combustion flow downstream for removal by the baghouse. NO_x is controlled by good combustion techniques. The cooling tower TSP and PM_{10} emissions are controlled by limiting water flow rate and total dissolved solids of the re-circulating water.

Kalaeloa Partners Cogeneration Plant

Kalaeloa Partners operates a cogeneration plant which generates electricity for its own use and for sale to Hawaiian Electric Company. This facility qualifies as a cogenerator since it also produces steam with the hot combustion gases. The steam is sold to Tesoro. Fuel oil is piped in from Tesoro and consumed by two combustion turbines. There is also a cooling tower which extracts heat from the combustion gases and emits particulates which are dissolved solids in the evaporated water.

TSP, PM_{10}, SO_2, and NO_x are the primary air pollutants being emitted from this facility. The following briefly describes the air pollution control methods being employed. SO_2 is controlled by the use of low sulfur fuel oil (< 0.5% sulfur by weight). NO_x is controlled by the use of steam injection which lowers the combustion temperature. The cooling tower TSP and PM_{10} emissions are controlled by limiting the water flow rate and amount of total dissolved solids within the water.

Tesoro Hawaii Refinery

Tesoro operates a petroleum refinery producing various types of petroleum products. Petroleum is imported by ship and stored in above ground tanks prior to processing. The petroleum is processed, or refined to produce various petroleum products. The main emission units are storage tanks, furnaces, boilers, a combustion turbine, cooling tower, and a flare.

TSP, PM_{10}, SO_2, NO_x, CO, and VOC are the primary air pollutants being emitted from this facility. The following briefly describes the air pollution control methods being employed. TSP and PM_{10} are mainly controlled by the consumption of fuel oil with a low ash content. The cooling tower TSP and PM10 emissions are controlled by limiting the water flow rate and amount of total dissolved solids within the water. SO_2 is controlled by the use of low sulfur fuel oil (< 0.5% sulfur by weight) and process controls such as a sulfur recovery unit. The sulfur recovery unit removes the sulfur from the gas streams which is condensed and sold as a solid. NO_x is controlled by the use of low NO_x burners in the heaters and water injection in the combustion turbine. VOC is controlled by the use of a flare, a thermal oxidizer for wastewater treatment, and the employment of proper leak detection and maintenance procedures. During the storage of the petroleum products, VOC is controlled with the use of various equipment for petroleum storage tanks such as gaskets, seals, and floating roofs. Slotted guide poles with sleeves were installed in 28 storage tanks to reduce fugitive VOC emissions.

TABLE A
2009 Campbell Industrial Park and Kahe Valley Major Source Criteria Emissions (tons/year)

Facility	TSP	PM_{10}	SO_2	NO_x	CO	VOC	Pb
AES [1]	310	269	1,770	747	545	23	0.09
Chevron [2]	139	103	944	494	139	1,122	0.20
HECO CIP Plant	16	16	4	23	91	1	0.00
HECO Kahe Plant	799	609	6,491	3,886	499	75	0.16
HPOWER [3]	149	133	91	1,105	127	5.2	0.54
Kalaeloa Partners	585	561	3,193	3,204	15	6	0.10
Tesoro [2]	91	83	1,018	1,058	318	392	0.02
TOTAL (tons/year)	2,089	1,774	13,511	10,517	1,734	1,624	1.11

Source: State Department of Health, Clean Air Branch October 2009. Based on Covered Source actual emissions as submitted by the respective sources.

TSP - Total Suspended Particulates
SO_2 - Sulfur Dioxide
PM_{10} - Particulate Matter with aerodynamic diameter less than or equal to 10 microns
NO_x - Nitrogen Oxides
CO - Carbon Monoxide
VOC - Volatile Organic Compounds
Pb - Lead

Note:
1. The nitrogen and sulfur content in the coal supply will continue to vary year to year.
2. The emissions will vary year to year depending on the demand for fuel.
3. The emissions may differ year to year due to the inconsistency of fuel (municipal waste).

SECTION 2.
Ambient Air Quality at Campbell Industrial Park: 2005 - 2009

The State of Hawaii enjoys some of the best air quality in the nation. However, as in any metropolitan area, we still experience our share of air pollution. In order to maintain Hawaii's air quality, pollution sources are regulated through the promulgation of rules and the issuance of air permits which limits emissions. The ambient air is monitored throughout the State by analyzers and meteorological equipment installed at strategic locations.

Air pollution is generated by many different sources. "Stationary sources" include those of factories, power plants, and refineries. "Area sources" are smaller stationary sources from which emissions are not easily associated with a single piece of equipment or activity. "Mobile sources" include cars, buses, planes, trucks, and trains. "Natural sources" are events such as wildfires, windblown dust, and volcanic eruptions. To protect the air quality, the Clean Air Act was enacted to provide the principal framework for National, and State efforts against air pollution.

The Clean Air Act established the National Ambient Air Quality Standards (NAAQS). The NAAQS is a set of health-based limits below which no adverse impacts to humans or the environment are anticipated. Two levels of standards are set in the NAAQS. "Primary" standards are designed to establish limits to protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly. "Secondary" air quality standards set limits to protect public welfare, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings.

The U.S. Environmental Protection Agency (EPA) has set national air quality standards for six principal pollutants referred to as "criteria" pollutants. These are sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), ozone (O_3), lead (Pb) and particulate matter. This last pollutant includes particulate matter with an aerodynamic diameter less than or equal to ten microns (PM_{10}) and two and a-half microns ($PM_{2.5}$).

Two other pollutants, not covered by the NAAQS, are mentioned in this report. Volatile Organic Compounds (VOC) are a precursor of O_3, and, consequently, of smog. Total Suspended Particulates (TSP) was replaced as a criteria pollutant by PM_{10}. Performance standards exist for VOCs and TSP within the Hawaii Administrative Rules and both pollutants are controlled by permit.

Hawaii's air quality meets or exceeds all of the federal standards for air pollution control. As an example, the State's Ambient Air Quality Standards for CO and NO_2 are more stringent than the NAAQS.

The Department of Health currently operates and maintains a network of nine National Air Monitoring Stations/State and Local Air Monitoring Stations (NAMS/SLAMS) on the island of Oahu. Of the nine stations, three were located in and around Campbell Industrial Park (CIP): Makaiwa, Kapolei and West Beach stations. The Makaiwa station was discontinued in the middle of 2009. Detailed descriptions of each monitoring station are provided below.

The ambient air quality trends are based on actual measurements of pollutant concentrations in the air. Air pollutant trends for the three stations during the most recent five years are graphically displayed while the tables summarize the highest concentrations and annual average concentrations. None of the air pollutants measured exceeded the national or state ambient air quality standards. The 1-hour and 8-hour CO, and 3-hour SO_2 trends are based on the annual average of the daily maximum concentrations in each calendar year. Annual trends are based on the average of all valid hourly measurements recorded in the year. Except for PM_{10}, the air quality trends for SO_2, NO_2, and CO in the CIP area have been relatively level and well below the national and state standards. The PM_{10} values show greater variability but are still well below the standards.

DEFINITIONS

1. The "Maximum Concentration" is the highest value recorded in the year for the averaging period.

2. The "Average of the Daily Max. Conc." is the annual arithmetic mean of all the daily maximum values recorded for the averaging period.

3. "98th percentile" for $PM_{2.5}$ is the 24-hour average that is higher than 98 percent of all valid 24-hour values recorded in the year. This is the value that is compared to the ambient air quality standard.

4. "Possible Periods" is the total number of possible sampling periods in the year.

5. "Valid Periods" is the total number of valid sampling periods after data audits.

6. "Annual Average" is the arithmetic mean of all hours recorded in the year.

MONITORING STATIONS

Kapolei

This station is located at 2052 Lauwiliwili Street approximately 200 yards south of the Desalination facility and the Kapolei Fire Station. The pollutants sampled at this station are carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), PM_{10}, and $PM_{2.5}$. Meteorological parameters measured are wind speed, wind direction and ambient temperature.

The $PM_{2.5}$ monitor was a filter-based manual sampler which operated once every 3 days until January 1, 2009 when it was replaced with a continuous sampler.

West Beach

This station is located within the Ko'Olina Golf Course, west of Campbell Industrial Park. It was established in February 1991 and currently monitors for NO_2, SO_2, and PM_{10}. Meteorological parameters measured are wind speed and wind direction.

The PM_{10} monitor at this site was a filter-based manual sampler which operated once every 6 days. It was replaced with a continuous PM_{10} monitor on January 1, 2009.

Makaiwa

This station was located at 92-670 Farrington Highway across from the Honokai Hale subdivision. Established in July 1989, this site monitored for SO_2, as well as wind speed and direction. With EPA approval, the station was discontinued on July 1, 2009 due to historically low data values and the need to redistribute resources to meet new monitoring requirements.

2009 Pollutant	Kapolei	West Beach	Makaiwa [1]
1-hour Carbon Monoxide (ppm)			
Maximum Concentration	3.7	-	-
Average of Daily Max. Conc.	0.39	-	-
Possible Periods	8760	-	-
Valid Periods	7931	-	-
State/Federal Standard	9 / 35		
8-hour Carbon Monoxide (ppm)			
Maximum Concentration	1.2	-	-
Average of Daily Max. Conc.	0.31	-	-
Possible Periods	8760	-	-
Valid Periods	8044	-	-
State/Federal Standard	4.4 / 9		
3-hour Sulfur Dioxide (ppm)			
Maximum Concentration	0.010	0.009	0.015
Average of Daily Max. Conc.	0.0016	0.0017	0.0028
Possible Periods	2920	2920	1448
Valid Periods	2544	2394	1395
State and Federal Standard	0.5	0.5	0.5
24-hour Sulfur Dioxide (ppm)			
Maximum Concentration	0.003	0.004	0.005
Average of 24-hour Concentrations	0.0009	0.0008	0.0015
Possible Periods	365	365	181
Valid Periods	359	345	180
State and Federal Standard	0.14	0.14	0.14
Ann. Ave. Sulfur Dioxide (ppm)			
Annual Average	0.0009	0.0008	0.0015
Possible Periods	8760	8760	4344
Valid Periods	8080	7997	4277
State and Federal Standard	0.03	0.03	0.03
Ann. Ave. Nitrogen Dioxide (ppm)			
Annual Average	0.004	0.003	-
Possible Periods	8760	8760	-
Valid Periods	8062	7665	-
State / Federal Standard	0.04 / 0.053	0.04 / 0.053	
24-hour PM_{10} ($\mu g/m^3$)			
Maximum Concentration	37	134[2]	-
Average of 24-hour Concentrations	16	16	-
Possible Periods	365	365	-
Valid Periods	352	356	-
State and Federal Standard	150	150	
Ann. Ave. PM_{10} ($\mu g/m^3$)			
Annual Average	16	16	-
Possible Periods	365	365	-
Valid Periods	352	356	-
State Standard	50	50	
24-hour $PM_{2.5}$ ($\mu g/m^3$)			
Maximum Concentration	25	-	-
98^{th} Percentile	12.5	-	-
Average of 24-hour Concentrations	6	-	-
Possible Periods	365	-	-
Valid Period	358		
Federal Standard	35		
Ann. Ave. $PM_{2.5}$ ($\mu g/m^3$)			
Annual Average	6	-	-
Possible Periods	365	-	-
Valid Periods	358	-	-
Federal Standard	15		

1 Makaiwa was shutdown on June 30, 2009, data year is incomplete.

2 High value attributed to construction vehicles traveling on the dirt road next to the station

2008 Pollutant	Kapolei	West Beach	Makaiwa
1-hour Carbon Monoxide (ppm)			
Maximum Concentration	2.2	-	-
Average of Daily Max. Conc.	0.37	-	-
Possible Periods	8784	-	-
Valid Periods	7239	-	-
State/Federal Standard	9 / 35		
8-hour Carbon Monoxide (ppm)			
Maximum Concentration	0.7	-	-
Average of Daily Max. Conc.	0.30	-	-
Possible Periods	8784	-	-
Valid Periods	7606	-	-
State/Federal Standard	4.4 / 9		
3-hour Sulfur Dioxide (ppm)			
Maximum Concentration	0.009	0.010	
Average of Daily Max. Conc.	0.0013	0.0018	0.5
Possible Periods	2928	2928	
Valid Periods	2205	2428	
State and Federal Standard	0.5	0.5	
24-hour Sulfur Dioxide (ppm)			
Maximum Concentration	0.005	0.005	0.14
Average of 24-hour Concentrations	0.0010	0.0009	
Possible Periods	366	366	
Valid Periods	320	359	
State and Federal Standard	0.14	0.14	
Ann. Ave. Sulfur Dioxide (ppm)			
Annual Average	0.0010	0.0009	0.03
Possible Periods	8784	8784	
Valid Periods	7174	8207	
State and Federal Standard	0.03	0.03	
Ann. Ave. Nitrogen Dioxide (ppm)			
Annual Average	0.004	0.003	-
Possible Periods	8784	8784	-
Valid Periods	7175	8289	-
State / Federal Standard	0.04 / 0.053	0.04 / 0.053	
24-hour PM_{10} ($\mu g/m^3$)			
Maximum Concentration	61	23	-
Average of 24-hour Concentrations	18	10	-
Possible Periods	366	61	-
Valid Periods	308	54	-
State and Federal Standard	150	150	
Ann. Ave. PM_{10} ($\mu g/m^3$)			
Annual Average	18	10	-
Possible Periods	366	61	-
Valid Periods	308	54	-
State Standard	50	50	
24-hour $PM_{2.5}$ ($\mu g/m^3$)			
Maximum Concentration	35[1]	-	-
98^{th} Percentile	21	-	-
Average of 24-hour Concentrations	5	-	-
Possible Periods	122	-	-
Valid Period	117		
Federal Standard	35		
Ann. Ave. $PM_{2.5}$ ($\mu g/m^3$)			
Annual Average	5	-	-
Possible Periods	122	-	-
Valid Periods	117	-	-
Federal Standard	15		

[1] Occurred during a very heavy vog day on Oahu

2007 Pollutant	Kapolei	West Beach	Makaiwa
1-hour Carbon Monoxide (ppm)			
Maximum Concentration	3.8	-	-
Average of Daily Max. Conc.	0.3	-	-
Possible Periods	8760	-	-
Valid Periods	8563	-	-
State/Federal Standard	9 / 35		
8-hour Carbon Monoxide (ppm)			
Maximum Concentration	0.8	-	-
Average of Daily Max. Conc.	0.3	-	-
Possible Periods	8760	-	-
Valid Periods	8614	-	-
State/Federal Standard	4.4 / 9		
3-hour Sulfur Dioxide (ppm)			
Maximum Concentration	0.01	0.006	0.031
Average of Daily Max. Conc.	0.002	0.001	0.003
Possible Periods	2920	2920	2920
Valid Periods	2487	2408	2856
State/Federal Standard	0.5 / 0.5	0.5 / 0.5	0.5 / 0.5
24-hour Sulfur Dioxide (ppm)			
Maximum Concentration	0.003	0.002	0.009
Average of 24-hour Concentrations	0.002	0.001	0.002
Possible Periods	365	365	365
Valid Periods	360	343	360
State/Federal Standard	0.14 / 0.14	0.14 / 0.14	0.14 / 0.14
Ann. Ave. Sulfur Dioxide (ppm)			
Annual Average	0.002	0.001	0.002
Possible Periods	8760	8760	8760
Valid Periods	8248	7977	8636
State/Federal Standard	0.03 / 0.03	0.03 / 0.03	0.03 / 0.03
Ann. Ave. Nitrogen Dioxide (ppm)			
Annual Average	0.005	0.003	-
Possible Periods	8760	8760	-
Valid Periods	8486	8373	-
State/Federal Standard	0.04 / 0.053	0.04 / 0.053	
24-hour PM_{10} ($\mu g/m^3$)			
Maximum Concentration	75[1] / 57	28	-
Average of 24-hour Concentrations	17	13	-
Possible Periods	365	61	-
Valid Periods	350	57	-
State/Federal Standard	150 / 150	150 / 150	
Ann. Ave. PM_{10} ($\mu g/m^3$)			
Annual Average	17	13	-
Possible Periods	365	61	-
Valid Periods	350	57	-
State Standard	50	50	
24-hour $PM_{2.5}$ ($\mu g/m^3$)			
Maximum Concentration	20	-	-
98^{th} Percentile	8	-	-
Average of 24-hour Concentrations	4	-	-
Possible Periods	122	-	-
Valid Period	111		
Federal Standard	35		
Ann. Ave. $PM_{2.5}$ ($\mu g/m^3$)			
Annual Average	4	-	-
Possible Periods	122	-	-
Valid Periods	111	-	-
Federal Standard	15		

[1] This is attributed to New Year's fireworks. The second number is the next highest value recorded in the year.

NOTE: Beginning with the 2007 report, all gaseous pollutants (CO, SO_2, and NO_2) have been reported in parts per million (ppm) to be consistent with federal reporting units.

2006 Pollutant	Kapolei	West Beach	Makaiwa
1-hour Carbon Monoxide ($\mu g/m^3$)			
Maximum Concentration	1596	-	-
Average of Daily Max. Conc.	224	-	-
Possible Periods	8760	-	-
Valid Periods	8615	-	-
State/Federal Standard	10,000/40,000		
8-hour Carbon Monoxide ($\mu g/m^3$)			
Maximum Concentration	1183	-	-
Average of Daily Max. Conc.	148	-	-
Possible Periods	8760	-	-
Valid Periods	8627	-	-
State/Federal Standard	5,000/10,000		
3-hour Sulfur Dioxide ($\mu g/m^3$)			
Maximum Concentration	12	24	62
Average of Daily Max. Conc.	5	4	8
Possible Periods	2920	2920	2920
Valid Periods	2526	2382	2868
State/Federal Standard	1,300/1,300	1,300/1,300	1,300/1,300
24-hour Sulfur Dioxide ($\mu g/m^3$)			
Maximum Concentration	8	7	17
Average of 24-hour Concentrations	5	2	4
Possible Periods	365	365	365
Valid Periods	363	350	362
State/Federal Standard	365/365	365/365	365/365
Ann. Ave. Sulfur Dioxide ($\mu g/m^3$)			
Annual Average	5	2	4
Possible Periods	8760	8760	8760
Valid Periods	8342	7945	8664
State/Federal Standard	80/80	80/80	80/80
Ann. Ave. Nitrogen Dioxide ($\mu g/m^3$)			
Annual Average	9	6	-
Possible Periods	8760	8760	-
Valid Periods	8663	7419	-
State/Federal Standard	70/100	70/100	
24-hour PM_{10} ($\mu g/m^3$)			
Maximum Concentration	59	33* / 22	-
Average of 24-hour Concentrations	16	12	-
Possible Periods	365	61	-
Valid Periods	355	57	-
State/Federal Standard	150/150	150/150	
Ann. Ave. PM_{10} ($\mu g/m^3$)			
Annual Average	16	12	-
Possible Periods	365	61	-
Valid Periods[4]	355	57	-
State/Federal Standard	50/50**	50/50	
24-hour $PM_{2.5}$ ($\mu g/m^3$)			
Maximum Concentration	34* / 9	-	-
98th Percentile	7	-	-
Average of 24-hour Concentrations	4	-	-
Possible Periods	122	-	-
Valid Period	116		
Federal Standard	65***		
Ann. Ave. $PM_{2.5}$ ($\mu g/m^3$)			
Annual Average	4	-	-
Possible Periods	122	-	-
Valid Periods	116	-	-
Federal Standard	15		

* This is attributed to New Year's fireworks. The second number is the next highest value recorded in the year.

** The federal annual PM_{10} standard was revoked by EPA on 12/17/06

*** The 24-hour $PM_{2.5}$ standard was revised to 35 $\mu g/m^3$ on December 17, 2006.

2005 Pollutant	Kapolei	West Beach	Makaiwa
1-hour Carbon Monoxide (μg/m^3)			
Maximum Concentration	1710	-	-
Average of Daily Max. Conc.	561	-	-
Possible Periods	8760	-	-
Valid Periods	8556	-	-
State/Federal Standard	10,000/40,000		
8-hour Carbon Monoxide (μg/m^3)			
Maximum Concentration	1055	-	-
Average of Daily Max. Conc.	453	-	-
Possible Periods	8760	-	-
Valid Periods	8551	-	-
State/Federal Standard	5,000/10,000		
3-hour Sulfur Dioxide (μg/m^3)			
Maximum Concentration	64	40	70
Average of Daily Max. Conc.	4	3	9
Possible Periods	2920	2920	2920
Valid Periods	2396	2521	2829
State/Federal Standard	1,300/1,300	1,300/1,300	1,300/1,300
24-hour Sulfur Dioxide (μg/m^3)			
Maximum Concentration	21	11	19
Average of 24-hour Concentrations	2	2	4
Possible Periods	365	365	365
Valid Periods	333	362	359
State/Federal Standard	365/365	365/365	365/365
Ann. Ave. Sulfur Dioxide (μg/m^3)			
Annual Average	2	2	4
Possible Periods	8760	8760	8760
Valid Periods	7809	8320	8606
State/Federal Standard	80/80	80/80	80/80
Ann. Ave. Nitrogen Dioxide (μg/m^3)			
Annual Average	9	6	-
Possible Periods	8760	8760	-
Valid Periods	8660	8087	-
State/Federal Standard	70/100	70/100	
24-hour PM_{10} (μg/m^3)			
Maximum Concentration	*53** / 36	33	-
Average of 24-hour Concentrations	14	12	-
Possible Periods	365	61	-
Valid Periods	352	60	-
State/Federal Standard	150/150	150/150	
Ann. Ave. PM_{10} (μg/m^3)			
Annual Average	14	12	-
Possible Periods	365	61	-
Valid Periods[4]	352	60	-
State/Federal Standard	50/50	50/50	
24-hour $PM_{2.5}$ (μg/m^3)			
Maximum Concentration	*55** / 11	-	-
Average of 24-hour Concentrations	4	-	-
Possible Periods	122	-	-
Valid Period	108	-	-
Federal Standard	65		
Ann. Ave. $PM_{2.5}$ (μg/m^3)			
Annual Average	4	-	-
Possible Periods	122	-	-
Valid Periods	108	-	-
Federal Standard	15		

* This is attributed to New Year's fireworks. The second number is the next highest value recorded in the year.

Figure 1. Annual Average of Maximum 1-hour Carbon Monoxide: 2005 - 2009

(Annual average of the daily maximum 1-hour values)

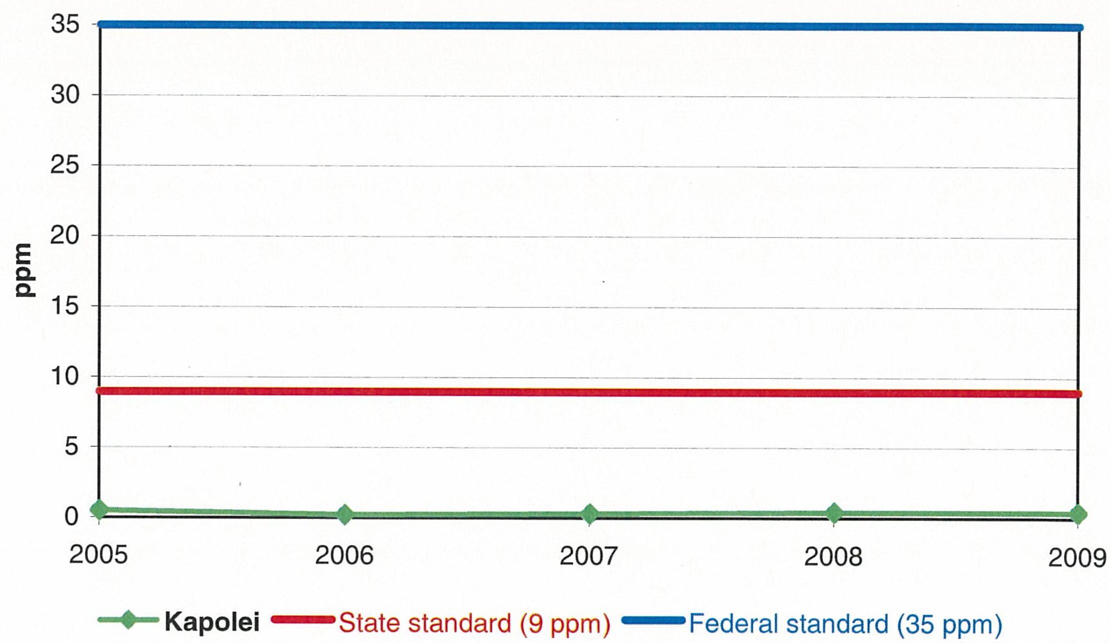


Figure 2. Annual Average of Maximum 8-hour Carbon Monoxide: 2005 - 2009

(Annual average of the daily maximum 8-hour values)

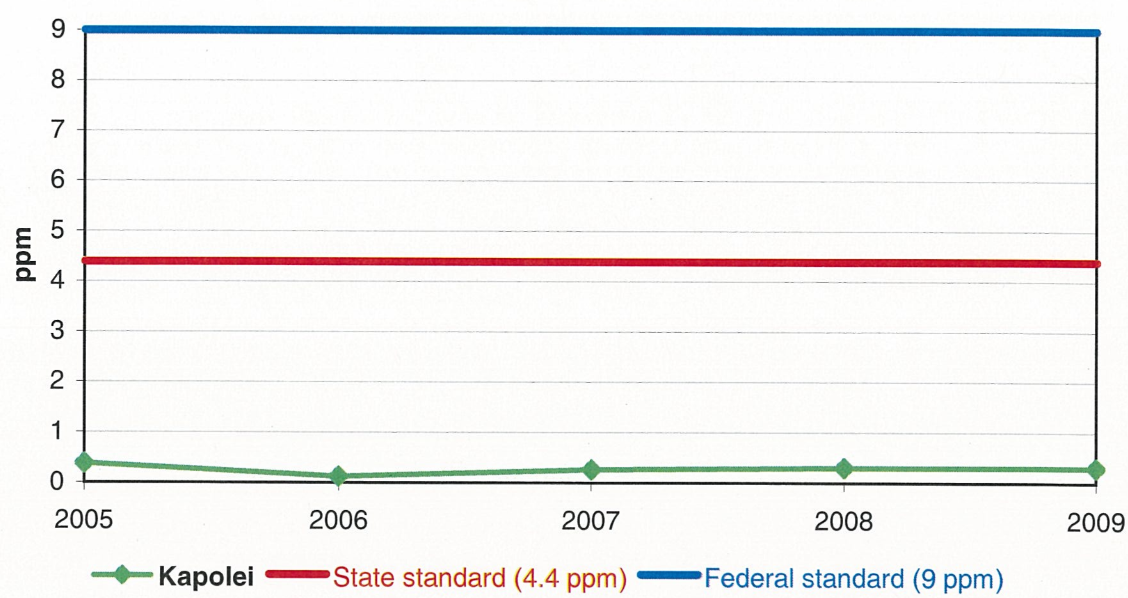


Figure 3. Annual Average of Maximum 3-Hour SO_2 2005 - 2009

(Annual average of the maximum 3-hour values)

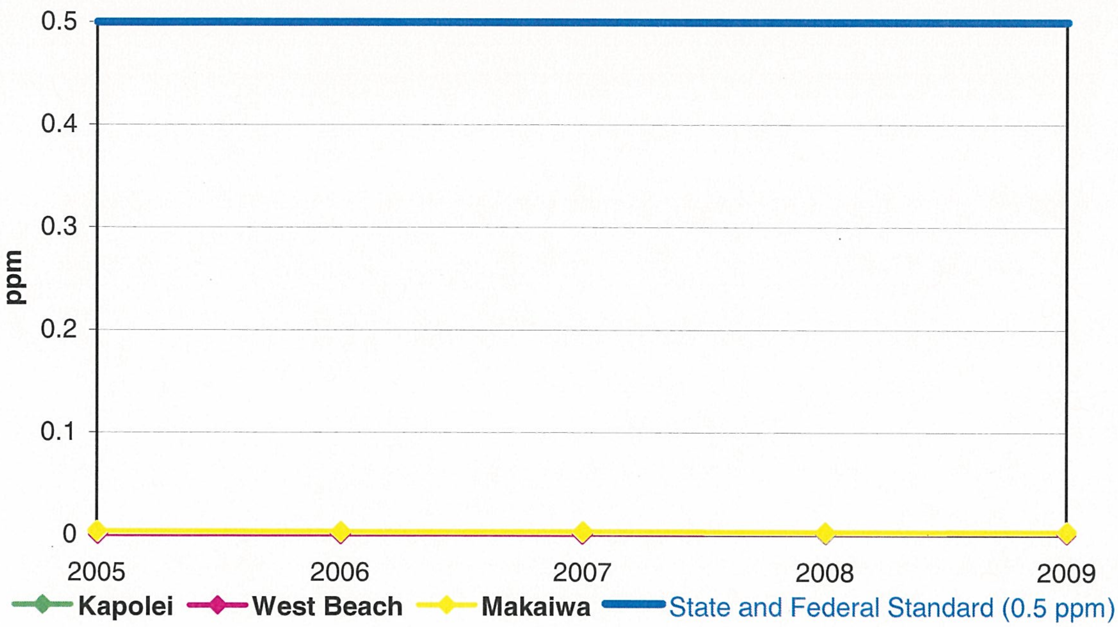


Figure 4. Maximum 24-hour Sulfur Dioxide 2005 - 2009

(The highest 24-hour value in the year)

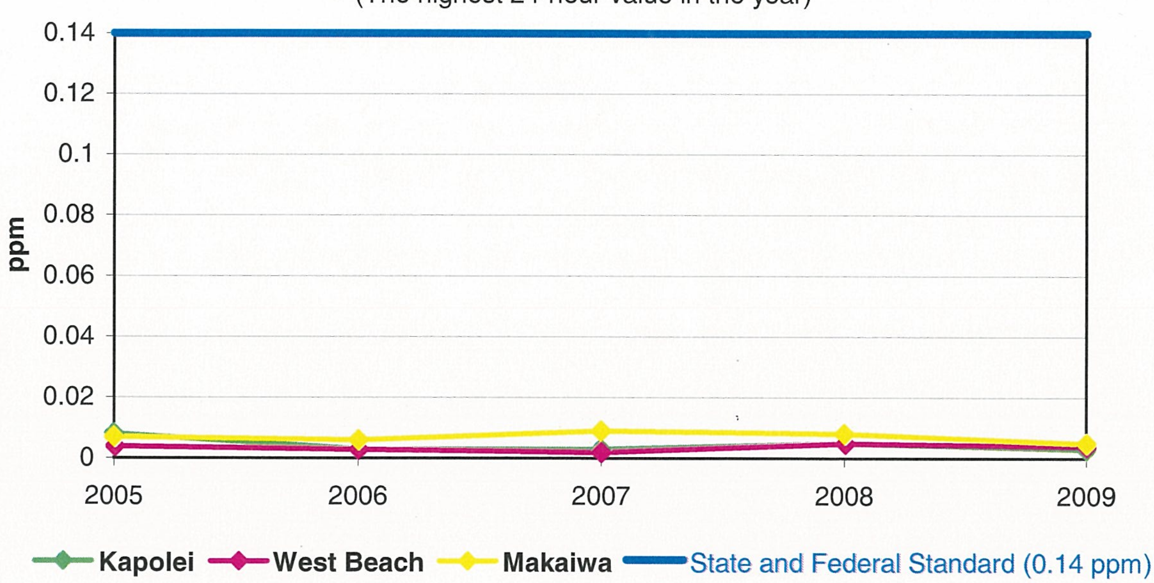
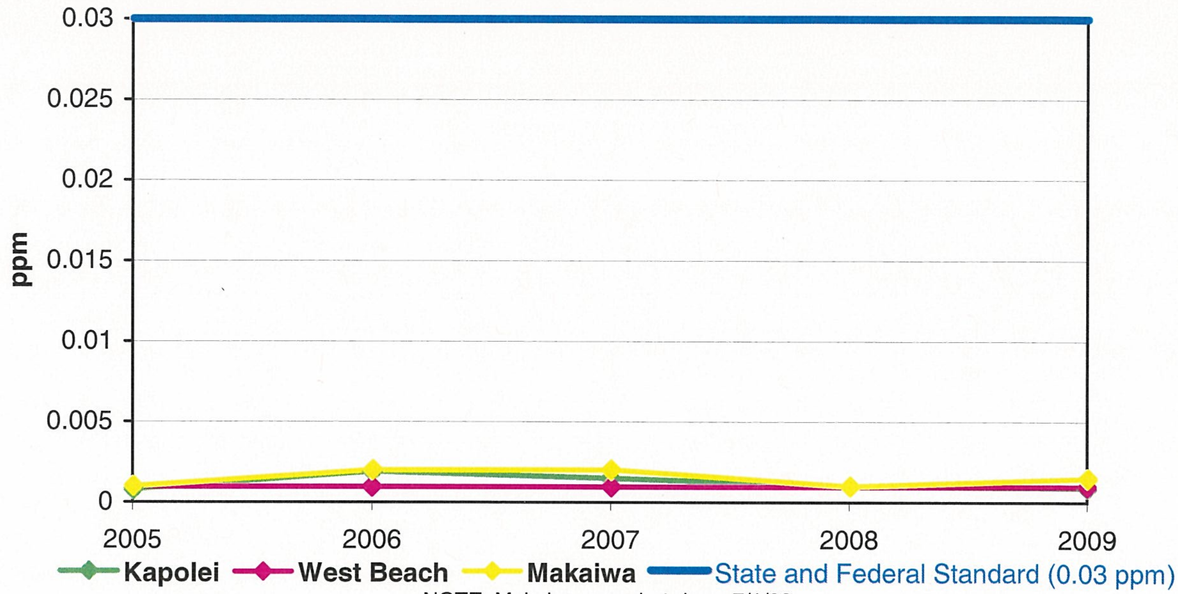


Figure 5. Annual Average of Sulfur Dioxide 2005 - 2009

(Average of all valid hours in the year)



NOTE: Makaiwa was shut-down 7/1/09

Figure 6. Annual Average of Nitrogen Dioxide 2005 - 2009

(Average of all valid hours in the year)

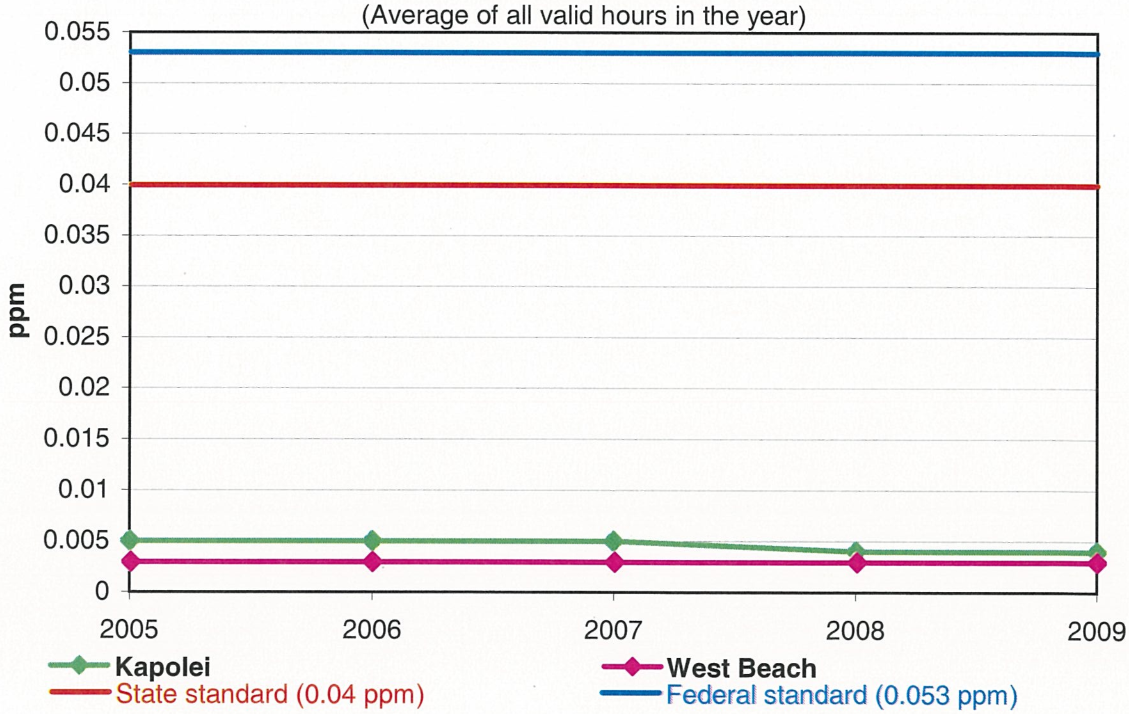


Figure 7. Maximum 24-hour PM_{10} : 2005 - 2009

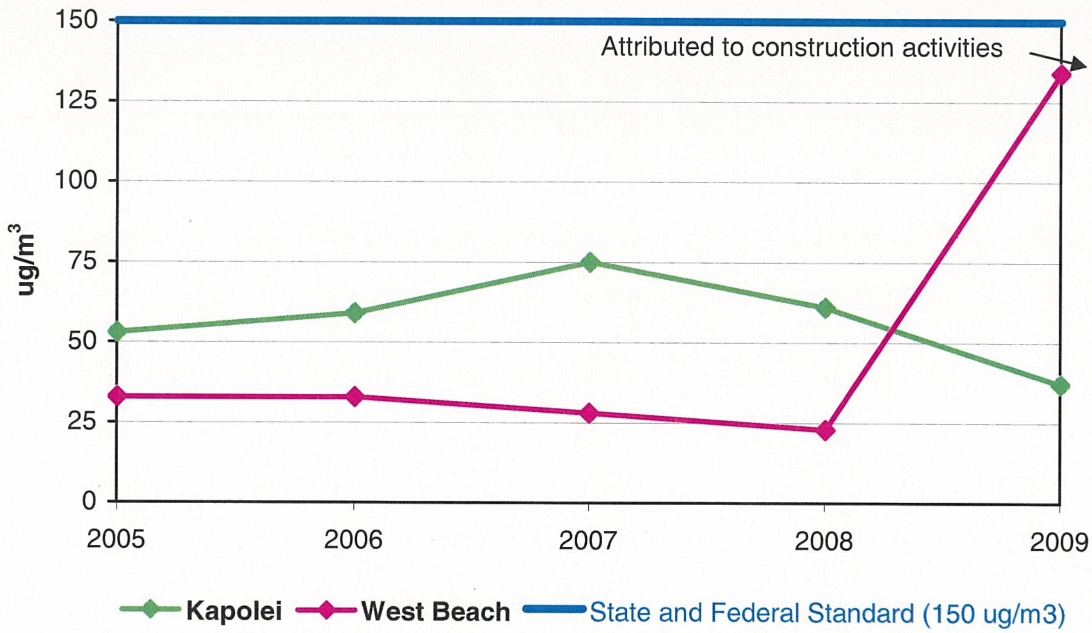


Figure 8. Annual Average of PM_{10}: 2005 - 2009

(Average of all valid 24-hour values in the year)

The federal standard was revoked by the EPA on 12/17/2006

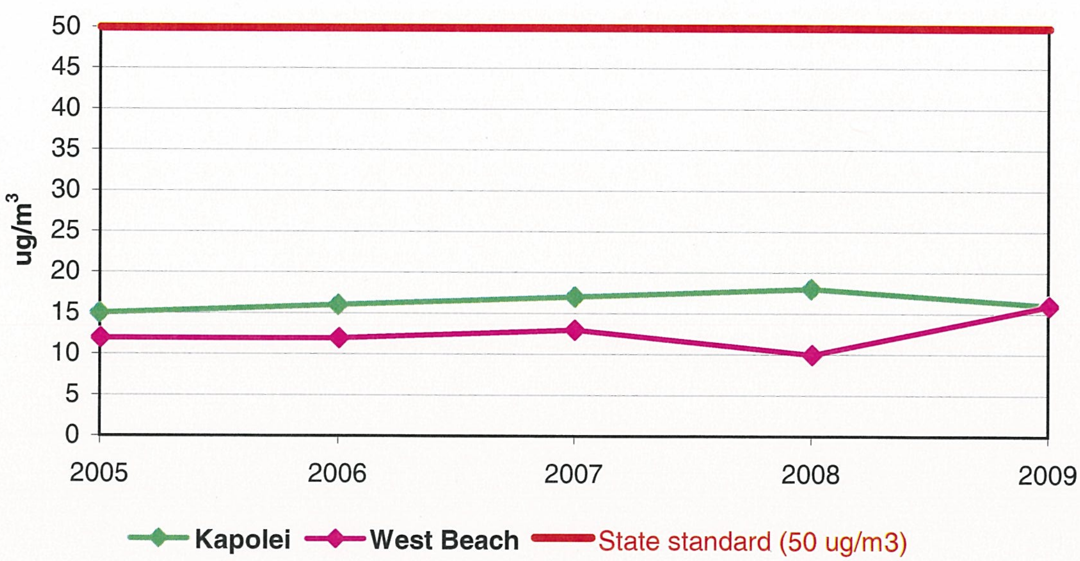


Figure 9. 98th Percentile 24-hour $PM_{2.5}$ 2005 - 2009

(This is the 24-hour average that is higher that 98% of all valid values in the year. To attain the standard, the 98th percentile value must not exceed the standard)

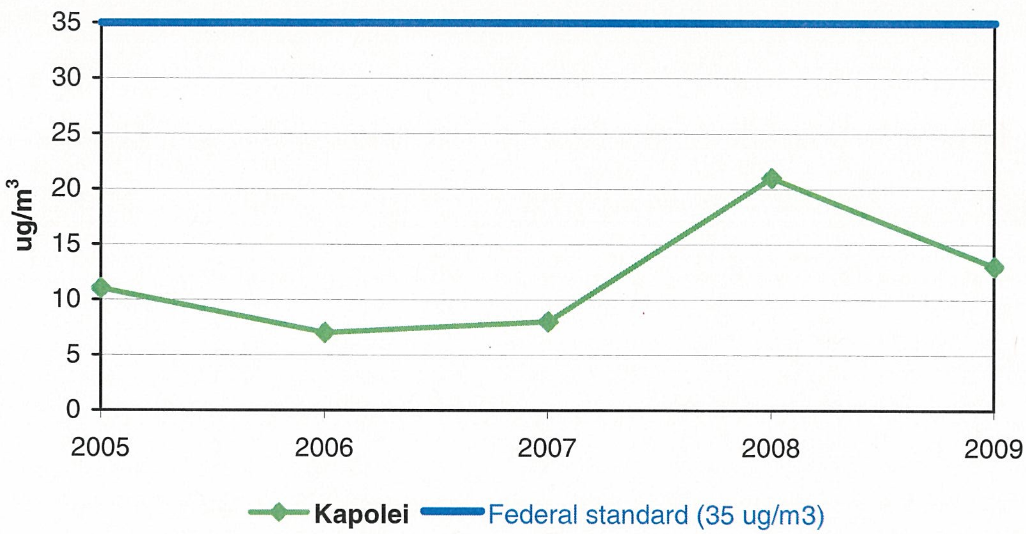
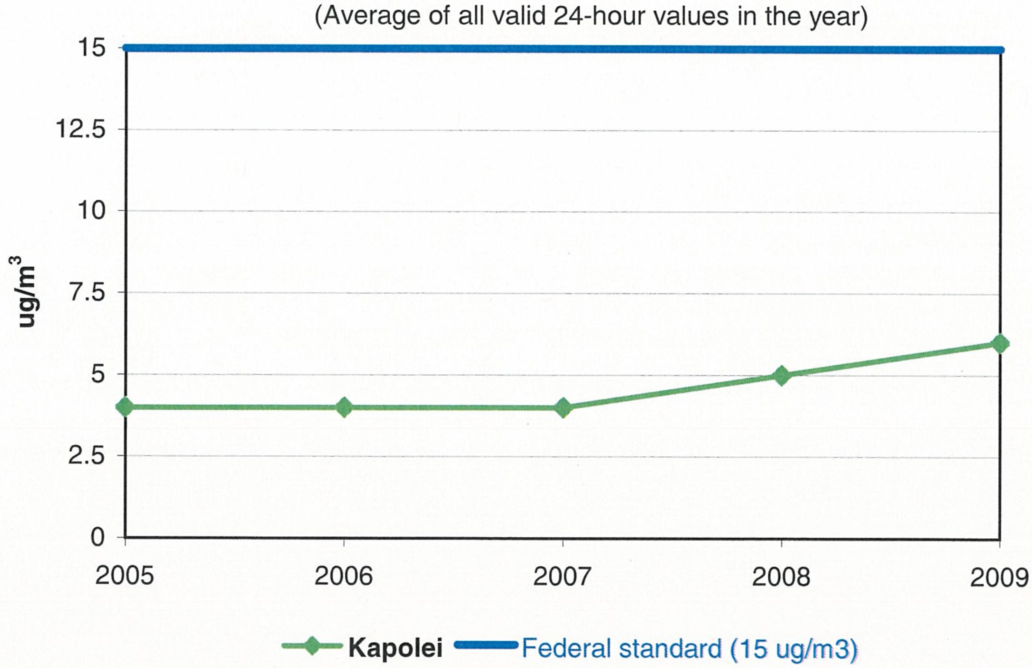


Figure 10. Annual Average of $PM_{2.5}$: 2005 - 2009

(Average of all valid 24-hour values in the year)



SECTION 3.
Measurements of Selected Criteria Pollutants in the Campbell Industrial Park Area and the Health Effects Expected at These Levels of Exposure

HEER Office, November, 2010

Criteria Pollutants

The United States government through the Environmental Protection Agency (EPA) Office of Air Quality Planning and Standards has established National Ambient Air Quality Standards (NAAQS) for six "criteria air pollutants" to be used as guidelines of exposure to protect human health from the possible effects of air pollutants. These standards are based on scientific studies in both epidemiology and controlled laboratory experiments often using human volunteer subjects. The six Criteria Air Pollutants include: ozone (O_3), airborne lead (Pb), particulate matter 10 micrometers and less in size (PM_{10}), carbon monoxide (CO), nitrogen dioxide (NO_2), and sulfur dioxide (SO_2). These pollutants were selected based on multiple criteria including their toxicity and their relative abundance and distribution in industrialized society.

The Clean Air Branch in the Department of Health has collected data for PM_{10}, CO, NO_2 at two locations in Campbell industrial Park (CIP), namely Kapolei and West Beach. $PM_{2.5}$ data were collected at the Kapolei location. These data are summarized for the years 2004 -2009 in Section 2 of this report.

The levels of these four criteria air pollutants measured in the CIP area are consistently below the National Ambient Air Quality Standards and Hawaii State Ambient Air Quality Standards.

Possible Health Effects of Criteria Air Pollutants at CIP

The following is an overview of some of the possible health effects of the four criteria air pollutants measured at CIP. This is *not* intended to be a complete or thorough description of the toxicology of these pollutants. Rather, this note aims to give some idea of the effects these pollutants can have *at high enough concentrations*. First, it is important to understand the first rule of toxicology: that taking a sufficient amount of *any* material into the body can produce toxic effects. The rate of intake can also influence toxic effects. Humans, on average over a day or more, typically breathe about 20 cubic meters of air per day. Because of this and available scientific data, we can get a fairly good idea of what concentrations of air pollutants are needed before adverse health effects are seen. Even so, there are no clear cut numbers below which, there is no risk and above which we are all at risk. Safety factors are then used to help compensate for uncertainties and to provide added protection for the more sensitive people in the population.

In the following paragraphs, the levels of pollutants measured in the CIP area in 2009 are compared to the NAAQS and the expected health effects for those levels of exposure are discussed as well as the effects that would be expected at much higher levels of exposure.

Sulfur dioxide (SO_2): The NAAQS levels for sulfur dioxide are set at 0.500 ppm for a three hour averaging period, 0.140 ppm for a 24-hour averaging period, and 0.030 ppm for a one year averaging period.

In 2009, the annual average was less than 0.002 ppm, well below the NAAQS of 0.030 ppm. The maximum concentrations measured for the 3-hour and 24-hour averaging times were below their respective NAAQS. The maximum 24-hour concentration measured was 0.005 ppm, while the maximum 3-hour concentration was 0.015 ppm.

Nitrogen dioxide (NO_2): The NAAQS level for nitrogen dioxide has been set at 0.053 ppm for a one year averaging period, and Hawaii has set that level at 0.040 ppm for added safety. The maximum annual average concentration measured in 2009 was 0.004 ppm, well below the Federal and State standard.

Sulfur dioxide (SO_2) and nitrogen dioxide (NO_2) are gases that, combined with water on the wet surfaces of the body, produce acids. *At high enough levels*, these acid gases are irritating to the lungs, eyes, nose and throat, and can cause shortness of breath. Levels found in the CIP area typically average less than 0.010 ppm. These levels of exposure are not expected to produce adverse health effects. For irritants such as the acid gases SO_2 and NO_2, sensitive individuals may have short-lived responses to brief peaks in concentration which would not appear in these averaged data. Such short-term peaks are more apparent in the maximum readings found in shorter term (1-3 hour) averaging times.

Carbon monoxide (CO): The NAAQS levels for carbon monoxide have been set at 35 ppm for a 1-hour averaging period, and 9 ppm for an 8-hour averaging period. Hawaii has set those levels at 9 and 4.4 ppm respectively for added safety. In 2009, the 1-hour average was 0.39 ppm and the 8-hour average was 0.31 ppm. These average levels of exposure are not expected to produce adverse health effects. In 2009, the maximum 1-hour concentration for carbon monoxide was 3.7 ppm. The maximum 8-hour concentration for carbon monoxide was 1.2 ppm.

Carbon monoxide (CO) is an odorless colorless gas that interferes with the ability of blood to carry oxygen. Symptoms of overexposure include headache, shortness of breath, dizziness at about 50-100+ ppm; severe headache, weakness, dizziness, nausea / vomiting fainting, rapid breathing at 400-500+ ppm; fainting, seizure, coma, respiratory failure, death at 1000-4000+ ppm. The highest one hour average level measured in the CIP area was 3.7 ppm.

<u>Particulate Matter 10 micrometers and less in size (PM_{10}):</u> The NAAQS level for PM_{10} has been set at 150 µg/m^3 averaged over 24 hours. Hawaii also has a standard of 50 ug/m^3 averaged over one year. In response to new scientific data, EPA revised the particulate matter standard in July, 1997 to include a standard for "fine particle" which are equal to or less than 2.5 micrometers in size ($PM_{2.5}$). These $PM_{2.5}$ standards were set at 65 µg/m^3 averaged over 24 hours and 15 µg/m^3 averaged over one year. On December 17, 2006 the 24-hour standard for $PM_{2.5}$ was lowered to 35 µg/m^3 to better protect the public from short-term fine particle exposure. Adverse health effects of particulate matter can include impaired lung function, a reduction in capacity for physical activity, complication of heart disease and increased population death rates. The levels of exposure producing adverse effects are even less clear cut than they are for the gases discussed above. Based on laboratory results and extensive epidemiology studies, the EPA has set the fine particulate standards to provide an increased measure of protection from adverse health effects due to particulate matter.

The 24-hour averages and the annual averages for PM_{10} were 16 µg/m^3 for Kapolei and West Beach. In 2009, the maximum 24-hour concentration was 37 µg/m^3 for Kapolei. The maximum 24-hour concentration for West Beach was 134 µg/m^3 which was attributed to construction vehicles traveling on the dirt road next to the station. Although the adverse health effects from these levels of exposure are currently controversial, these averages are similar to Honolulu which has one of the lowest urban PM_{10} levels in the United States. The 24-hour average and the annual average for $PM_{2.5}$ were 6 µg/m^3 for the one monitoring site in Kapolei, well below the Federal standard. In 2009, the maximum 24-hour concentration was 25 µg/m^3 below the Federal standard.